STUDY PROJECT

SPACE SYSTEMS REQUIREMENTS: THE NAVY APPROACH

BY

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SPACE SYSTEMS REQUIREMENTS: THE NAVY APPROACH

AN INDIVIDUAL STUDY PROJECT

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ABSTRACT

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Each of the armed services has a unique approach and bureaucracy for identifying systems requirements and application of space systems to its operational forces. For thirty years, the Navy has been the leader in usage of space systems by its tactical forces. This paper reviews the historical and existing institutional structure of the naval space organization, some of the uses of space systems by operational units, and the naval processes for identification of future systems requirements. Observations are made that the Navy experienced great success early on in the use of space. After a period of seeming malaise, the Navy's space program began a renaissance in the 1980's which is still in progress. As is often the case, in order to understand where you are, and what options are in front of you, one needs to understand how you arrived at the present state. A review of selected portions of the history of the U.S. space efforts in general, the naval space program in particular, and the military challenge of Soviet space achievments opens this paper. Portions of current institutional structuring of naval space organization are the result of policy decisions made 30 years ago. The author offers suggestions toward potential enhancement of the Navy's space requirements process in the increasingly joint environment.

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INTRODUCTION

I. THE SPACE RACE

It was in 1926 that the work of Johannes Winkler in Dessau, Germany gave rise to the German rocket program. A major incentive for Germany's pursuit of a rocket program was the Versailles Treaty restrictions on German development of heavy artillery capability. Rocket-powered missiles offered a technical loophole in the treaty restrictions. Such a loophole soon became irrelevant under Hitler. Before the end of World War II, the Germans had produced large numbers of rocket-powered missiles and were using them as supersonic artillery against the Allies. German developments included advanced homing devices such as infrared, television, radio and acoustic. German missiles hit Allied fleets in the Mediterranean. Called Vengeance 2 (V-2), Germany's new ballistic missiles had a 200nm range. Already in use by the fall of 1944 to deliver 750kg warheads on Great Britain, further developments in rocket technology promised imminent ability to actually hit America with rocket-powered missiles. However, with the Russian army closing in from the east, von Braun and the German rocket teams took their inventions and moved south to surrender to the Americans in May 1945. At war's end, the transfer of some V-2 rockets and the German scientific teams to America continued research and development

under both U.S. Navy and Army Air Force programs.

When the United States entered World War II it had no rocket weapons. American interest in rocket power was confined to a few visionaries who were unable to scratch any significant funding out of the federal budget. By the end of the war the American rocket program budget was 13 million dollars.

The Navy's involvement with rocket propulsion and guidance systems resulted in a report on "Feasibility of Space Rocketry", dated November 6, 1945. The authors, Commander Harvey Hall and Lieutenant Robert DeHavilland, were members of a study group formed by the Navy's Bureau of Aeronautics to determine future rocket applications. Robert Truax, one of America's early rocket pioneers and wartime associate of Dr. Robert H. Goddard, said the report "represents the first United States space program."[1] The report proposed a project for constructing and launching an earth satellite. The project, called HATV (High Altitude Test Vehicle), purported to achieve an orbit around the earth in the early 1950's. Astronomical costs estimated at eight million dollars led the Navy, in 1946, to propose the project as a joint program with the Army Air Force. Although impressed with the concept, the Army Air Force responded a few days after the March 7th meeting that they would not support the satellite program. Instead, the Army Air Force contracted with RAND Corporation to conduct its own feasibility study. The subsequent RAND report led to an ambitious Army Air Force space program, and the race was on; not this time between Germans and Americans, but between

the U.S. armed service branches. Later that year the Army Air Force successfully launched a V-2 rocket into non-orbital space. In July 1947 the U.S. Air Force was created. Independent satellite studies by the three services were pursued. The Navy's HATV research continued until 1948 when already minimal budgets were cut by the Joint Research Development Board.

The interservice competition was resurrected in 1954 as scientific communities announced plans to study expected sunspot activity in 1957-1958. The International Scientific Committee commissioned a program known as the International Geophysical Year (IGY). The goal of the program was to launch a small scientific satellite. On July 29, 1955, President Eisenhower announced his commitment to orbit a small unmanned satellite in support of IGY. After DoD study of competing proposals from the three services, the Navy was selected to proceed with its project: Vanguard.

The Naval Research Laboratory (originally the Naval Experimental and Research Laboratory founded by Thomas A. Edison after World War I) worked the Vanguard proposal under the directorship of Dr. John Hagen. A contract was awarded to the Martin Company for the building of a brand new advanced design of satellite launch vehicle. The satellite program became a joint, tri-service effort. Army teams prepared tracking stations where IGY scientists would obtain data from the satellite. The Air Force provided the launch facilities at Cape Canaveral. The Navy pursued development and testing of the satellite and rocket

systems.

Steady progress continued in testing the new designs incorporated in launch vehicles for the Vanguard project. Although Vanguard was a fairly open operation, the press considered it uninteresting and gave it little coverage. As Americans focused their attention on the World Series between the Yankees and the Braves in early October 1957, an event occured which was called America's technological Pearl Harbor: the Soviet launch of Sputnik I.

Suddenly public pressure to launch a U.S. satellite swelled. President Eisenhower took to the airwaves to assure the American public that Sputnik did not represent a threat to national security. He also tried to convince the press that it did not indicate Soviet technological superiority over the United States. Despite assurances, however, the American space program experienced a Challenger-like catastrophe on December 6 as TV-3 exploded after rising only a few feet off the launching pad. The Secretary of Defense ordered the Army to proceed with its satellite program using proven military rocket boosters. On January 31, 1958, Explorer I restored national confidence as it was put into orbit by the Army team led by Dr. Wernher von Braun. Finally, on March 17, Vanguard I rose flawlessly into orbit. It was the first satellite to use solar power and operated for over seven years. The Vanguard program, though considered by von Braun to be the superior U.S. program, had suffered many growing pains in its new design technology.

In the days after Vanguard, the Air Force increased its share of the DoD space budget to fifty per cent and beyond. The Army and Navy both fell from the budget limelight, but the Navy went on to pursue development of several space systems to support its fleets. Some of the events which supported those achievements are described below.

II. NAVY SPACE GENESIS

The "Feasibility of Space Rocketry" report in late 1945 laid an important foundation for the ultimate success of the Navy's Vanguard project thirteen years later. During those years, most of the work was naturally done under the cognizance of the Naval Research Laboratory and the Navy's Bureau of Aeronautics. Vanguard became the milestone in Navy space efforts which encouraged the pursuit of a more deliberate and organized space program.

Vanguard produced a cadre of personnel, both in and out of the Naval Research Laboratory and the Bureau of Aeronautics, with a vision towards future space applications. One such visionary was Navy Captain Bob Truax. While assigned to the Bureau of Aeronautics between 1953 to 1955, he authored an independent study: "A Means for Making the Guided Missile Submarine a Primary Naval Weapon". After two years of making his case, the Bureau rejected his concept for an SLBM. Captain Truax sought and gained assignment to the Air Force ballistic missile team. (Ironically, the Navy accepted the SLBM concept later that year

under a different study.)

Captain Truax was immediately placed in charge of a new missile known as the Thor IRBM. Later, Captain Truax became deputy director of the Air Force's advanced reconaissance program which fielded the photo-reconaissance satellite Samos. A short tour in the newly formed Advanced Research Projects Agency (ARPA) was followed by a pre-retirement return tour to the Bureau of Aeronautics. His boss there, Captain Thomas F. Connolly, head of the Navy's Pacific Missile Range, charged Captain Truax with convening an ad hoc committee (under CNO directive) "to recommend policy on the use of space and the science of astronautics."[2]

The "Connolly Committee" membership included 19 officers with expertise in the areas of concern. The committee convened for a period of ten weeks. Their report, "The Navy in the Space Age", advanced approximately 100 specific recommendations regarding policy, programs and organization, and essentially became the Navy's master space plan. The CNO, Admiral Arleigh Burke, "approved in principle"[3] the report's conclusions and directed implementation and further planning based on the report. One major recommendation of the committee was the creation of a space organization within the existing structure of the Navy Department, and not as a special or vertical group. Following this recommendation, Admiral Burke charged DCNO (Air) with overall responsibility and authority to direct the Navy Astonautics program, excluding research and development, using the existing organizational structure of OPNAV. OP-54, the

Astronautics Operations Division, was established to provide this staff function. DCNO (Development) was charged with astronautics research and development. OP-761, the Space and Astronautics Branch under OP-76 was established to support this function. Of note, Captain Connolly in later years became Vice Admiral Connolly, Deputy Chief of Naval Operations (Air), and therefore was in direct control of continued implementation and oversight of the Navy space program he had helped to formulate.

Concurrent with the formation of the Navy's space programs, the U.S. Air Force had embarked on a robust space program. The Air Force organization and particularly their system of Study Requirements (SR's) served as a source of stimulus and support for research and development. Industry looked at possible Air Force projects and programs and committed their own top technical talent and funds to concept investigation. Industry was willing to bear these costs in an effort to capture a market sector to replace the loss of aircraft contract business after World War II and Korea. From these industry option proposals the Air Force easily selected projects of genuine promise. The trend snowballed, particularly in strategic applications, and today the Air Force possesses, according to one USAWC guest speaker, 80-90 per cent of the personnel and budget for military space. (Figure 1).

At first glance, it appears that the Air Force has edged the other services almost entirely out of the space picture. Yet Chief of Naval Operations Admiral Trost, stated in a 1987 address

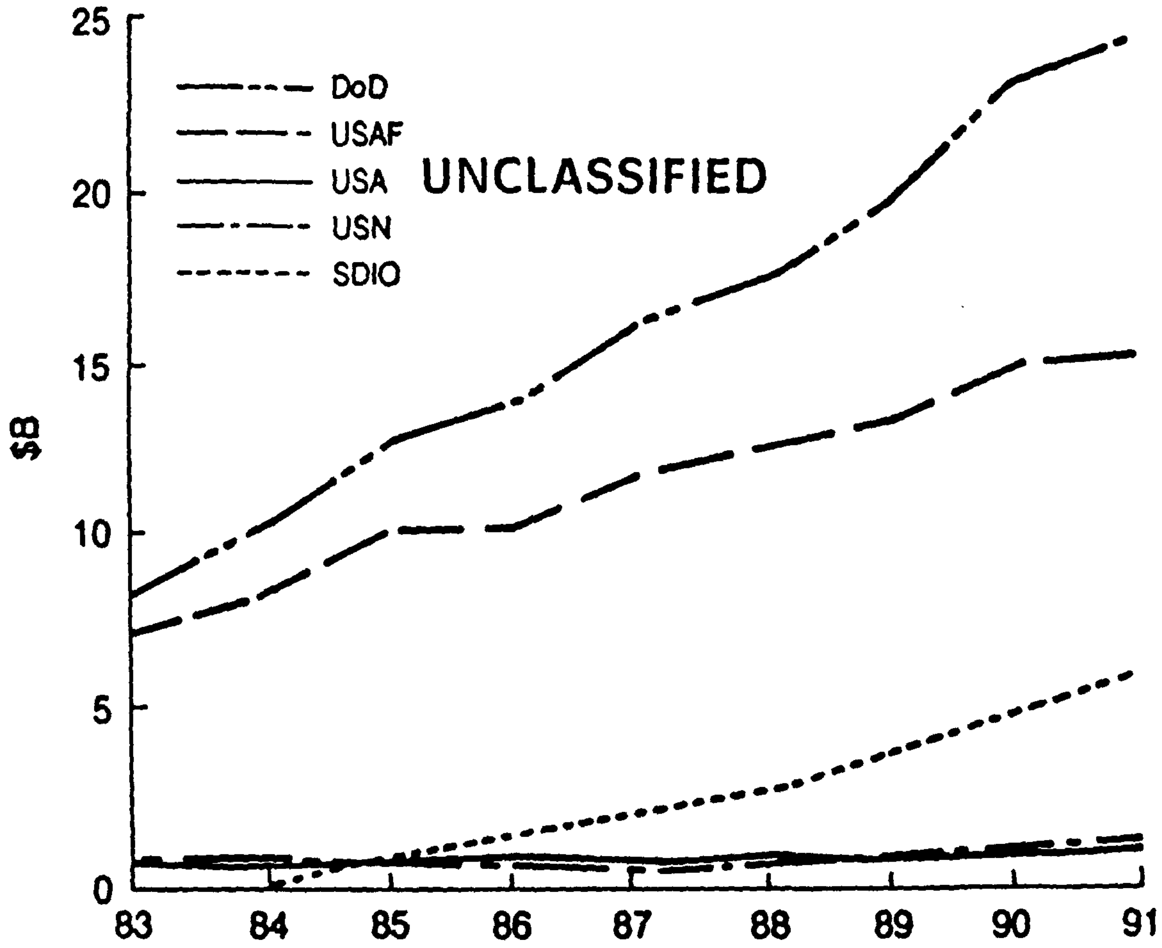

Figure 1 DoD space-related expenditures

Source: Committee on Emerging Space Technologies

that "Today, the Navy is our country's number one client of space systems, owning roughly 80 per cent of the assets in orbit or awaiting deployment."[4] The most recent Naval Space Master Plan published in 1989 states that "The Navy's use of space systems to support tactical operations has grown steadily during the last thirty years. Today, more than 85% of all satellite data used by U.S. military forces is used by naval forces."[5]

Since those statements were made, much has transpired. The U.S. Army has embarked on a vigorous space program of its own. The Desert Shield/Desert Storm Operations of 1990/1991 did much to force space assets into the hands of tactical users in all service branches. The percentages quoted above are therefore not likely accurate any longer. The point is not, after all, the interservice competition in space programs. If we should focus our attention at all in that regard it must be on the rivalry posed by the Soviet threat to all of our armed forces.

III. THE SOVIET CHALLENGE

> "Mastery of space is an important prerequisite for achieving victory in war."
> Dictionary of Basic Military Terms, USSR, 1965

The purpose of this paper is not to announce or evaluate the Soviet space threat. The brief point needs to be made, however, that U.S. forces are not acquiring space systems in a threat vacuum as a mere convenience to the tactical unit. The importance of space assets to future naval conflicts has been instructed by several recent Chiefs of Naval Operations.

"Sea control will likely become dependent upon the control of space."[6] Admiral T.B. Hayward, USN

"When combined with the advantages of space basing, these [technological] advances could change the basic nature of naval warfare before the next century. The opening round in a future war could well be a battle to gain control of space. The victor would likely have a decisive advantage in controlling the seas."[7]

"The Navy of the future is going to be inextricably linked to space capabilities. Space control is sea control. Whoever controls space will control the seas."[8] Admiral James Watkins, USN

The above statements indicate the evaluation of space as an important military priority by some of our nation's most senior defense leaders. What do the Soviets themselves think? In December 1990, the National Defense University Press published <u>The Voroshilov Lectures, Materials from the Soviet General Staff Academy</u>. Volume II provides broad view of the fact that the Soviets clearly have a doctrine of space exploitation on both strategic and tactical levels. More telling than similar Soviet sources, is a look at what the Soviets are actually doing in space.

Since 1966, the Soviets have consistently outlaunched the U.S. in orbiting satellites. In 1985 (pre-Challeger), the Russians' 98 space launches compared to 17 for the U.S. This proportion was not an abberation, but part of a long term trend. The Soviets also outspend the U.S. in space programs by roughly 2 to 1.[9]

Differences in design and employment philosophy account for part of the disparity. Soviet satellites are generally thought to have shorter useful service lives and may be less reliable compared to U.S. systems. Still the 1988 figures for satellites maintained in orbit were Soviets: 170, U.S.: 100.[10] This is a significant difference to be explained simply by different orbitology requirements or technological edge. Afterall, we underestimated the Soviet technology in 1957.

Technological edges or parity may be a moot point if mission area gaps exist. The Soviets are the only nation that maintains an operational orbital interceptor ASAT system. Their two space-based reconaissance systems, RORSAT and EORSAT, have no comparable U.S. counterpart. The SALYUT and MIR manned space stations have had possible military applications, while the U.S. Space Station Freedom remains the domain of the architects' drawing board.[11]

The current change of political landscape in eastern Europe does not negate the space threat or obviate the need for space assets for U.S. forces. "The vital importance of space and counter-space support to U.S. naval operations is unaffected by the changes we are witnessing in the international security environment."[12] Even if direct conflict were to be avoided in the long term, the influence of Soviet space assets in proxy operations and third party conflicts is clear. U.S. News and World Report revealed that U.S. intelligence has data proving the Soviets realigned their satellites in order to provide Iraq photographic data for targeting Scud missile attacks into Israel

and Saudi Arabia during the Kuwait War. The Soviets are also reported to have aided the Iraqis by providing satellite vulnerability schedules, and information on technical capabilities of American satellites.[13]

During a two month period of the Falkland Islands War, the Soviets launched at least eleven satellites with high inclinations to cover the South Atlantic theater.[14] The Soviet satellite information apparently provided the Argentines with militarily valuable data.[15] Did this information aid in attacks such as that on the HMS Sheffield?

In addition to the earlier mentioned mission area gaps, another "gap" is depicted by the demonstrated robust contingency launch capability of the Soviets during the Falkland Islands War. In the event of a space war, the Soviets clearly have the ability to rapidly reconstitute satellite constellations lost to hostile action. This, combined with their already large number of satellites, could provide extended service to Soviet terrestial forces long enough to provide a decisive space superiority and determine the land or naval war. The U.S. ability to reconstitute its satellite force, particularly following the space shuttle program problems, is less clear.

The above discussion briefly illustrates the environment in which U.S. military space acquisition must be considered. The following statements speak for themselves.

"And we are falling farther behind in a race that affects not only ASW and naval warfare but our very national security. Today we know that in wartime, even in a conventional war of limited duration, the two superpowers would fight a battle of attrition in space until one side or the other had wrested control. And the winner would then use the surviving space systems to decide the contests on land and sea. Today, that superpower would probably not be the United States. Despite our successes in the past, despite our superior technological base, we are today farther behind the Soviet Union in the military application of space technology than we were when Sputnik first went up. In short, the Soviets are prepared to go to war in space, and we're not."

Admiral Carlisle A.H. Trost, U.S. Navy
Chief of Naval Operations, 1987 [16]

"The 1976 Soviet Military Encyclopedia notes that 'during the course of war, military space systems capable of destroying space and also ground (naval) targets will be of decisive significance.' In 1987, General Secretary Mikhail Gorbachev stated, 'We do not intend to relax our efforts and lose our vanguard position in the conquest of space.'"[17]

ENDNOTES

1. "Rocket Power," Naval Aviation News, November 1970, p. 32.

2. CNO letter OP-507/who Ser 7055P50 of 3 April 1959, Ad Hoc Committee on Astronautics, convening of(U).

3. CNO letter OP-05G5/shl Ser 0027P05G of 13 July 1959, Report of Ad Hoc Committee on Astronautics, promulgation and implementation of(U).

4. Admiral Carlisle A.H. Trost, USN, "The Potential of Space and Anti-Submarine Warfare," Defense Issues, Vol.2, No. 41, 1987, pp.2-3.

5. U.S. Department of the Navy. OPNAVNOTE S13300/CMCNOTE S13300: Naval Space Master Plan. 5 September 1989, p. E-1.

6. CNO Long Range Planning Group. The Role of Space in Naval Warfare, 8 June 1982, p. 2.

7. Ibid.

8. "Interview: William E. Ramsey, Vice Admiral, U.S. Navy," Proceedings, October 1988, p. 147, (hereafter referred to as Ramsey).

9. Paul B. Stares, Space and National Security, pp. 9-11.

10. Ramsey, p. 149.

11. Department of Defense, The Soviet Space Challenge, pp. iii-11.

12. CNO Executive Panel Task Force, Report on Navy Space Policy(U), March 1990, p. 2.

13. "Washington Whispers," U.S. News and World Report, 11 February 1991, p. 18.

14. Bruce W. Watson and Peter M. Dunn, Military Lessons of the Falkland Islands War: Views from the United States, pp. 139-161.

15. General T.R. Milton, USAF (Ret.), "Too Many Missing Pieces," Air Force Magazine, December 1982, p. 48.

16. Trost, pp. 3-4.

17. General John L. Piotrowski, USAF, "A Joint Effort," Proceedings, February 1990, p. 36.

CHAPTER TWO

NAVAL SPACE

I. SPACE SYSTEMS

In view of the unclassified nature of this paper, what follows does not pretend to be an exhaustive tabulation of space systems used by naval forces. Readers who are interested in a more complete description or listing are referred to appropriate publications in the bibliography. Those readers possessing a SECRET clearance and having access are specifically recommended to a relatively new publication by Naval Space Command, the *Space Tactics Manual*. It is designed as a quick reference guide to space systems for operational personnel. Patterned somewhat along the lines of the *Tactical Action Officer's Handbook*, it is organized around various space mission areas. Unless otherwise noted, satellite system information which follows is based on unclassified descriptions in the *Space Tactics Manual* or the *Naval Space Master Plan*(1989).

Many of the earlier space systems used by the Navy were the result of requirements advanced in the Connolly committee report in 1959. Where possible, illustative background of how these systems were acquired or how the requirements were originated is included. Discussions are organized by functional areas.

A. Navigation

1. Navy Navigation Satellite System (NNSS): NNSS, originally known as TRANSIT, was the first navigation satellite to be developed. Primarily designed to provide positional fixing to the Polaris missile submarines, TRANSIT was quickly applied to the Navy's surface fleet also. Eventually the system was declassified and made available for civilian users.

TRANSIT was the result of a design proposal by the Applied Physics Laboratory (APL), Johns Hopkins University in 1958. The Navy developed the system using ARPA funding. The first TRANSIT was launched in April 1961, and the system became operational in 1964. The Navy Astronautics Group at Point Mugu, California was responsible for launch (from Vandenberg AFB) and operation. TRANSIT satellites are built by RCA.

TRANSIT provides passive, global two-dimensional position information accurate to 100-200 meters, and time accurate to 50 microseconds. Fix accuracy depends on terrestrial platform velocity input. A velocity input error of one knot can cause up to a 400 meter fix error. Positional information is obtained by RF doppler techniques using two frequencies transmitted by the satellite. Coverage is world-wide, but not continuous. Fix intervals can be as long as 110 minutes at the equator. Time required for a user to generate a position fix is 8 to 20 minutes during the satellite pass.[1] Such a system is obviously not adequate for use by high performance aircaft, but strike aircraft inertial systems could be updated from ship's satellite fixing

data prior to launch. To date, the system has demonstrated outstanding dependability with an availability rate in excess of 99 per cent.

The current constellation consists of three NOVA (newer, improved versions) and four OSCAR (older models) spacecraft, with five on-orbit spare OSCARs. The satellites operate in circular near polar orbit at an altitude of 590 nautical miles. The three craft in the NOVA series are nuclear hardened, the OSCAR series are not. In 1987, one of the satellites logged 20 years of continuous service making it the longest-lived operational satellite. TRANSIT will be phased out for military use in 1994 when NAVSTAR/GPS is expected to be completely operational.

2. NAVSTAR/GPS: Navigation System Using Timing and Ranging (NAVSTAR)/Global Positioning System (GPS) is already replacing the TRANSIT navigation system. When fully operational in 1993, the constellation will consist of 21 satellites plus three on orbit spares. Subscribers will receive 24-hour, passive, worldwide three-dimensional position information accurate to 15 meters, user velocity information accurate to 0.1 meter/second, and time accurate within 100 nanoseconds. The satellites operate in semi-synchronous (12 hour) circular orbits inclined 55 degrees at an altitude of 10,900 nautical miles.[2] The Rockwell International built spacecraft are nuclear hardened and can operate in a high-jamming environment. GPS is the host platform for the nuclear detection system (NDS), capable of detecting nuclear testing and other nuclear events.[3]

The development of GPS is a Joint Services Program. The Air Force is designated as the executive agency, with all other services and civil agencies coordinating their requirements through the Joint Space Program Office (JSPO) at the Air Force Space Division. The Air Force is responsible for all aspects of development, launch, deployment and operation of the GPS satellite system. Each of the armed services is responsible for the development and procurement of service unique user equipment. The first NAVSTAR satellite was launched in 1978 as a joint Navy/Air Force effort. The Naval Research Laboratory did the functional experiments that formed the core of GPS.[4]

B. Communications

Satellites now carry the overwhelming majority of the fleets' long-haul strategic and tactical communications traffic. They provide clear, reliable channels for voice, teletype and digital traffic. The operational communicator is no longer at the mercy of unreliable HF links which depended on ionospheric conditions. Fleets can also easily communicate in haven areas such as fjords, and near elevated coastlines that once obstructed communications efforts.

1. MARISAT (GAPFILLER): In 1976, three COMSAT General Maritime Satellites (MARISATs), supplied by Hughes Aircraft Corporation, were launched to provide a UHF system for Navy tactical voice communications. These leased satellites provided a GAPFILLER until the Navy's own fleet satellite (FLTSAT)

communicatons constellation could be fielded in 1978 and subsequent years. Orbits were geostationary.

2. <u>FLTSAT and UHF Follow-On (UFO)</u>: The first FLTSAT was launched in 1973, however the system was not operational until the late 1970s. This project had been developed under the Navy Space Program Office, a 1970 forerunner of the Navy Space Office in what today is the Space and Naval Warfare Systems Command (SPAWAR).

The FLTSAT system includes five fully operational satellites, built by TRW Corporation, in geostationary orbit. The system provides voice, teletype and digital tactical and stategic UHF links to ships, submarines, aircraft and shore installations. Each satellite hosts 23 communications channels, 12 of which are dedicated to AFSATCOM and another channel is shared by the two services. The last two FLTSATs contained EHF prototype channels to MILSTAR (discussed below), and provide anti-jam, low probability of intercept capability. Worldwide coverage is provided between 70 North and 70 South latitudes. To extend well into the 1990s, the Navy's UHF Follow-On program will launch ten more satellites as replacements to FLTSAT between 1992 and 1997. Each will host 39 channels.

3. <u>LEASAT</u>: The Leased Satellite (LEASAT) system is a replacement for the MARISAT program. Like MARISATs, LEASATs are leased from Hughes Aircraft Corporation. The LEASAT is designed as a shuttle launched craft with an intended program run from 1984 to 1992 as an adjunct to the FLTSAT system.

LEASAT consists of four satellites in geostationary orbit. Each craft hosts 13 UHF channels: seven channels are used by the Navy, the remaining six are used by the Air Force.

4. DSCS II/DSCS III: Defense Satellite Communications System provides SHF communications for long-haul, high data rate communications such as World Wide Military Command and Control System (WWMCCS), strategic communications links, selected flagships and SURTASS (surface towed array surveillance system) ships. These geostationary satellites are managed by the Air Force and are controlled by Defense Communications Agency (DCA). DSCS is not used for tactical naval communications other than for the limited applications listed above.

5. MILSTAR: The Military Strategic, Tactical, and Relay (MILSTAR) Satellite System is designed as an EHF package host to provide survivable strategic and tactical communications capability that is nuclear hardened and less vulnerable to laser attack. The system is scheduled for operation in the 1990s. Four satellites will be put in geostationary orbits, and four more will have inclined orbits to cover the polar regions above 70 degrees.

MILSTAR is a joint service program managed by a Joint Program Office headed by the Air Force as is the case with GPS (discussed earlier). MILSTAR, however, will only provide 41 percent of total validated requirements. Therefore, the Navy initiated UHF Follow-On, a commercial purchase program. The program will provide twice the capacity of MILSTAR at a lower

cost.[5]

6. Artic Comms: The Arctic Communications satellite is a PD-40 SPAWAR project scheduled for launch in 1994. It is designed as a small, low flying satellite that will pick up tactical communications in the store and forward mode from submarines in polar regions. This system program is an example of one developed as part of the POM process using the current normative model for identification of naval space requirements.[6]

7. PROFILE: The Passive Radio Frequency Interference Location Experiment (PROFILE) is scheduled for 1991 launch. It is a relatively low cost Navy project developed by the Naval Research Laboratory using discretionary R & D funding from the Naval Space Command.[7] The program purpose is to provide operational concept testing of a sensor package designed to geolocate UHF interference sources. This program was initiated by NRL and is an example of a project which is not the result of a fleet requirement input.

C. Environmental/Geophysical Monitoring

Although the Navy only operates one environmental satellite, it routinely derives data from four systems for reasonably direct use by fleet operating forces. Additional civil and commercial systems are accessed less routinely. Environmental monitoring includes meteorology, oceanography and geodesy.

1. GEOSAT: The primary mission of the Geodetic Satellite (GEOSAT) is to provide the Navy and Defense Mapping

Agency with altimeter data used for improvements in gravitational models required by advanced submarine-launched ballistic missile systems. Secondary products include wave height, surface wind speed, sea ice mapping and tracking of oceanographic currents and eddies for use by the submarine and ASW communities.

The GEOSAT was produced by the Navy in coordination with APL of Johns Hopkins University, and was launched in March 1985. The primary geodetic mission lasted nineteen months and then the satellite was repositioned to optimize the secondary environmental mission. GEOSAT operates in circular, near polar, low earth orbit. The spacecraft is controlled by JHU/APL with support management assistance from the Naval Satellite Control Center, Point Mugu, California (formerly known as NAVASTROGRU). Already beyond its designed on-orbit life of four years, it failed in January 1990. It was the only all-weather data source on ocean fronts and eddies.

A GEOSAT Follow-On, which includes a microwave radiometer to penetrate atmospheric moisture, is in work as a commercial buy through SPAWAR. OP-94, Director of Space and Electronic Warfare, is the sponsor who wrote the operational requirement.[8]

2. DMSP: Designed and built by RCA in 1971, the Defense Meteorological Satellite Program (DMSP) is operated by the Air Force and provides all DoD services with real-time cloud cover data, atmospheric temperature and moisture profiles, sea surface temperatures and wind speed, and sea ice mapping data. A follow-on generation of DMSP satellites known as DMSP Block 6 is

in development with initial operation capability planned for 1998.

3. GOES/POES: Two satellites operated by the National Oceanic and Atmospheric Administration (NOAA) provide civil global environmental observation. GOES operates in a geosynchronous orbit, while POES is in a circular, near polar low earth orbit.

Two Polar Operational Environmental Satellites (POES) are normally in operation. They provide high resolution visual and infrared cloud imagery, atmospheric temperature and humidity profiles, and sea surface temperature. POES is also host to an international Search and Rescue (SAR) service package. POES provides global coverage, particularly in the polar regions not covered by GOES. Direct readouts are available to ships equipped with SMQ-10/11 receivers.

The Geostationary Operational Environmental Satellites (GOES) series carry sophisticated meteorological sensor packages developed by various commercial companies. Two GOES satellites provide continuous coverage from 70 degrees North to 70 degrees South latitude. As with POES, direct weather facsimile readouts can be obtained by ships equipped with SMQ-10/11 receivers.

4. SMQ-11: A service unique operational requirement for an upgraded weather facsimile receiver for fleet users was initiated in 1986 by OP-96, Oceanographer of the Navy. The system provides enhanced resolution weather facsimile readout directly from meteorological satellites to aircraft carriers,

LHAs and other specified ships. It is mentioned here as another example of a "top-down" requirements initiation. The SMQ-11 is designed and manufactured by the Naval Avionics Center. SMQ-11s were on two carriers during Operation Desert Storm and all carriers are scheduled to receive the upgraded system in coming years.[9]

D. Surveillance

Most of the data on surveillance programs is classified. This section will briefly discuss material found in open sources as an example of naval systems in this mission area.

The Naval Space Surveillance Center (NAVSPASUR) exploits the infrared capability of Defense Support Program (DSP) early warning satellites to detect and track missile plumes, and provides space and missile threat warning to the fleet.[10] After processing at ground sites, indication and warning data is rapidly relayed to fleet units via the Tactical Event Reporting System (TERS) using JOTS and/or AUTODIN. Early warning of Scud missile launches during Operation Desert Storm was obtained from DSP satellites.[11] The Naval Space Command's Slow Walker initiative provides processing software for near real-time dissemination of DSP data to fleet units over the Joint Operational Tactical System (JOTS).[12] NAVSPASUR also provides satellite vulnerability data to fleet users via JOTS and AUTODIN which allow commanders to know when they are susceptible to observation by Soviet satellites.

The above discussion has covered only a few of the programs under certain functional areas as examples of the Navy's extensive and routine use of space assets by tactical forces. Also illustrated were examples of how the Navy determined requirements for and acquired selected space systems. A full description of naval space systems is beyond the scope of this paper. A listing of additional space functional areas in Figure 2 demonstrates the greater breadth of the subject.

II. SPACE ORGANIZATIONS.

Naval space organization has been in the past somewhat fragmented and relatively small. As discussed in Chapter I, the CNO decision was to splice the naval space organization into existing Department of the Navy structure, as had been recommended in the 1959 "Connolly Committee" report. At that time a conscious choice was made not to create a separate vertical organization to sponsor space warfare issues. While the organizational changes since those early days have been numerous and significant, the present day structure still reflects the early decisions in varying degrees.

Not until the 1980s were sweeping changes toward creating a vertical space organization within the Navy seen. These changes were primarily in the operational organizations. The organizational renaissance has not equally affected the materiel side. The joint and acquisition restructuring in DoD in the wake of the Goldwater-Nichols Bill and the Packard Commission Report

SPACE MISSION AREAS	NAVAL SPACE FUNCTIONAL AREA
FORCE ENHANCEMENT	COMMAND AND CONTROL
	COMMUNICATIONS
	COUNTERSURVEILLANCE
	ENVIRONMENTAL MONITORING
	NAVIGATION
	TACTICAL WARNING & ATTACK ASSESSMENT
	TERRESTRIAL SURVEILLANCE
	WEAPONS TARGETING
SPACE SUPPORT	LAUNCH
	LOGISTICS
	ON-ORBIT CONTROL
	PERSONNEL
SPACE CONTROL	DENIAL
	SPACE SURVEILLANCE
	SURVIVABILITY & ENDURANCE
FORCE APPLICATION	DEFENSIVE
	OFFENSIVE

Figure 2: Naval Space Functional Areas

will make Navy acquisition of future space systems more difficult.

Below is a brief overview of naval space organizations. An organizational chart is provided in Figure 3.

A. OP-094

On August 1, 1990, the CNO established naval space warfare as a Department of the Navy directorate on par with surface, air and undersea warfare directorates. OP-094, formerly the Space, Command and Control Directorate became the Space and Electronic Warfare Directorate. As a "three-star" warfare directorate, OP-094 became the requirements advocate for all space systems during the program objectives memoranda (POM) process. The current OP-094, Vice Admiral Tuttle is asking the fleet flag commanders to drive SEW requirements.[13] In the past, design and implementation authority of C^3I programs resided in OP-094, while electronic warfare programs using space were directed by OP-07. The recent redesignation of OP-094 as a warfare directorate for space will help to integrate these programs.[14] Naval Space Command reports to CNO via OP-094.

B. Naval Space Command

The Naval Space Command (NAVSPACECOM) was commissioned on 1 October 1983. It is a second echelon operational command commanded by a Rear Admiral (O-7). The purpose in establishing NAVSPACECOM was to consolidate DoN organizations and activities

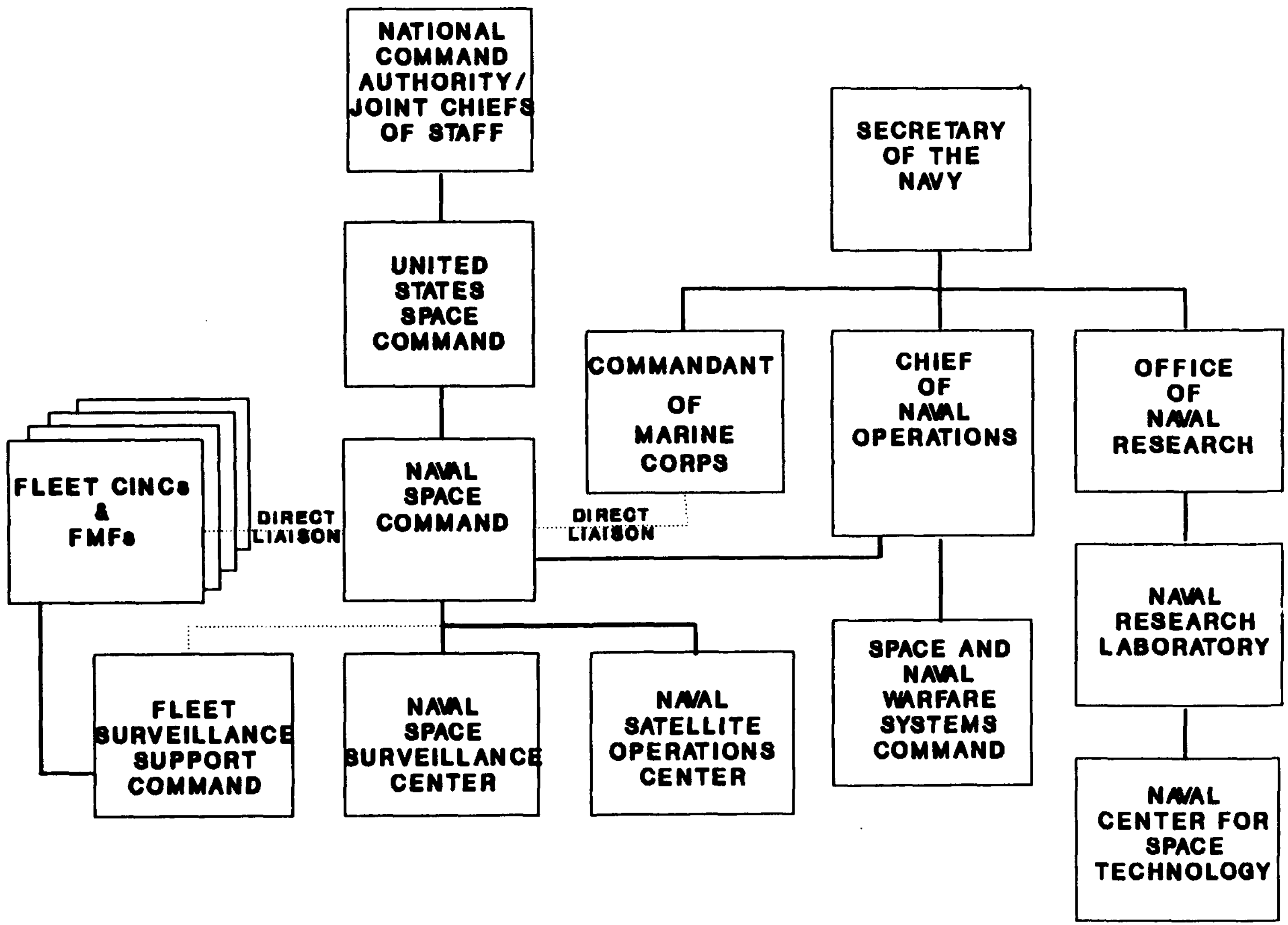

Figure 3 NAVAL SPACE ORGANIZATION

that operate or maintain naval space systems. NAVSPACECOM is the naval component of the unified command structure under USCINCSPACE. Naval Space Command is charged with helping "to organize, train, equip and administer naval space forces in support of USSPACECOM."[15]

Naval Space Command consists of a headquarters staff at Dahlgren, Virginia. It has three subordinate commands: the Naval Satellite Operations Center (NAVSOC), the Naval Space Surveillance Center (NAVSPASUR), and the Fleet Surveillance Support Command (FSSC). A dedicated Naval Space Operations Center (NAVSPOC) in the Naval Space Command headquarters building focuses on exploiting space systems to support tactical naval forces.

C. NAVSPASUR

NAVSPASUR, located in Dahlgren, Virginia and commanded by a Navy Captain, was established in 1961. The command operates a space surveillance system set up by the Naval Research Laboratory to detect, identify and track satellites. The system is a network of UHF bistatic radar transmitter and receiver sites along the 33rd parallel in the southern United States from San Diego, California to Glennville, Georgia. The interferometric "fence" can detect volleyball sized objects up to an altitude of 15,000 nautical miles. NAVSPASUR constantly updates a space catalog containing about 7,000 objects in orbit. This information is also used to provide satellite vulnerability

(SATVUL) data to the fleet via JOTS. Additional fleet support includes Slow Walker/TERS which provides over-the-horizon missile warning.

NAVSPASUR has served as the Alternate Space Surveillance Center (ASSC) and Alternate Space Defense Operations Center (ASPADOC) since 1984 to back-up the Cheyenne Mountain SSC and SPADOC.

D. NAVSOC

In late 1990, the Naval Astonautics Group (established in 1962) was renamed the Naval Satellite Operations Center. The new title more accurately describes the mission performed by this command. NAVSOC is located at the Pacific Missile Test Center, Point Mugu, California. The command operates the Navy Satellite Control Network which flies satellites on orbit using EHF control nodes. NAVSOC has tracking and injection facilities in Maine, Minnesota, California and Hawaii. The network of space-ground links is highly automated and can be operated at the sites themselves or remotely from Pt. Mugu. NAVSOC directly operates satellite control for the twelve TRANSIT satellites, and four other spacecraft. Navy control/support is also provided by NAVSOC for six FLTSATs and four LEASATs. When GEOSAT Follow-On and the Arctic Communications systems are launched, it is expected NAVSOC will also control them.

E. FSSC

Naval Space Command's newest subordinate command is the Fleet Surveillance Support Command which operates the Navy's Relocatable Over-the-Horizon Radar (ROTHR) system. ROTHR is a land based radar system that can detect ships and aircraft at ranges in excess of 1,000 nautical miles. While Naval Space Command retains administrative control of FSSC and its detachments, Fleet CINCs will have operational control of ROTHR detachments in their areas of responsibility.

F. NRL/Naval Center for Space Technology

The Navy Center for Space Technology was established at the Naval Research Laboratory in 1985. A significant percentage of NRL funds, civilian staff and on-site NRL contractor personnel is managed by this group. This organization is only informally coupled with SPAWAR, an arrangement which has weakened the Navy's potential to provide space systems necessary to support its operational needs.[16]

NRL has conducted an ambitious and expert research and development program for 30 years. Some 130 satellites and satellite payloads have been produced. The R & D orientation is towards Navy-related scientific investigation and device development.[17]

Neither NRL nor its space technology center is under the command chain of Naval Space Command. NRL reports to the Office of Naval Research. The lines of authority between SPAWAR and the

Naval Center for Space Technology are not clear.[18]

G. SPAWAR

In 1985, the Naval Electronics Systems Command was renamed the Space and Naval Warfare Systems Command (SPAWAR). Within SPAWAR there are two primary space offices: the Assistant Commander for Space Technology (SPAWAR-004), and the Space and Sensor Systems Program Directorate (PD-40). In 1970, PD-40's predecessor was the Navy Space Program Office (PM-16) under the Chief of Navy Materiel. This is the organization which developed the FLTSAT program. In 1973, PM-16 was disestablished and its functions were transferred to the Navy Space Project (PDE-106), part of the then Navy Electronics Systems Command.[19] As can be seen above, throughout the Navy's involvement with space, there has always been involvement by NRL, and since at least 1970 some form of systems program office or directorate. Though the names have changed, little in the way of substantive reorganization has been achieved on the materiel/acquisition side of the house. In view of the sweeping changes in recent years in the acquisition environment, especially as applies to space warfare, it appears advisable that a more formal merger of the Naval Center for Space Technology with SPAWAR be established.

ENDNOTES

1. U.S. Space Command, Operational Space Systems Assigned to USCINCSPACE, Fact Sheet, p. 1.

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3. Thomas C. Brandt, "The Military Uses of Space," in America Plans for Space, ed. by National Defense University, p. 103.

4. Interview with Patrick Kluever, CDR, USN, Dahlgren, 13 February 1991.

5. Richard H. Buenneke, Jr., "The Army and Navy in Space," Air Force Magazine, August 1990, p. 39.

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7. Ibid.

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9. Ibid.

10. "Mideast Forces Get Help from on High," Military Space, October 8, 1990, p. 4.

11. "Space Operations," Military Space, March 11, 1991, p. 6.

12. "Mideast Forces Get Help from on High," p. 4.

13. "Space and Electronic Warfare Comes of Age," Proceedings, January 1991, p. 94.

14. Department of the Navy, Final Report of the CNO Executive Panel Task Force on Navy Space Policy, CNO Memorandum Ser 00/0S500107 of 8 May 1990.

15. Naval Space Command, Naval Space, Fact Sheet, p. 1.

16. Naval Studies Board, Implications of Future Space Systems for the U.S. Navy, p. 16.

17. Committee on Emerging Space Technologies, Assessment of Implications of Present and Future Space Systems for the Army, p. 74.

18. CNO Executive Panel Task Force on Navy Space Policy.

19. Frederick J. Glaeser, "Space: A New Dimension in Naval Warfare," Proceedings, May 1987, pp. 134-135.

CHAPTER THREE

NAVAL SPACE REQUIREMENTS PROCESS

I. OVERVIEW

The chart shown in Figure 4 provides an overview of the requirements process used by the Navy to produce space systems programs. The arrangement of commands in Figure 4 depicts working relationships and the routing of documents, not necessarily chain of command structures. The chart is a general treatment of what can be a very intricate planning, programming, and budgeting system (PPBS). Many officers who have worked in assignments dealing with PPBS find that just understanding their "piece of the elephant" is a major milestone in mastering the complex system. This chapter will not exhaust all the permutations possible under PPBS. It will provide a general description of the normative method of the requirements process. As was already seen in Chapter II, there are some exceptions to this rule when systems are initiated by "top-down" action, or by NRL or APL projects.

II. FLEET CINC

Space requirements can be identified by operational forces when an operational capability deficiency is noted, or an

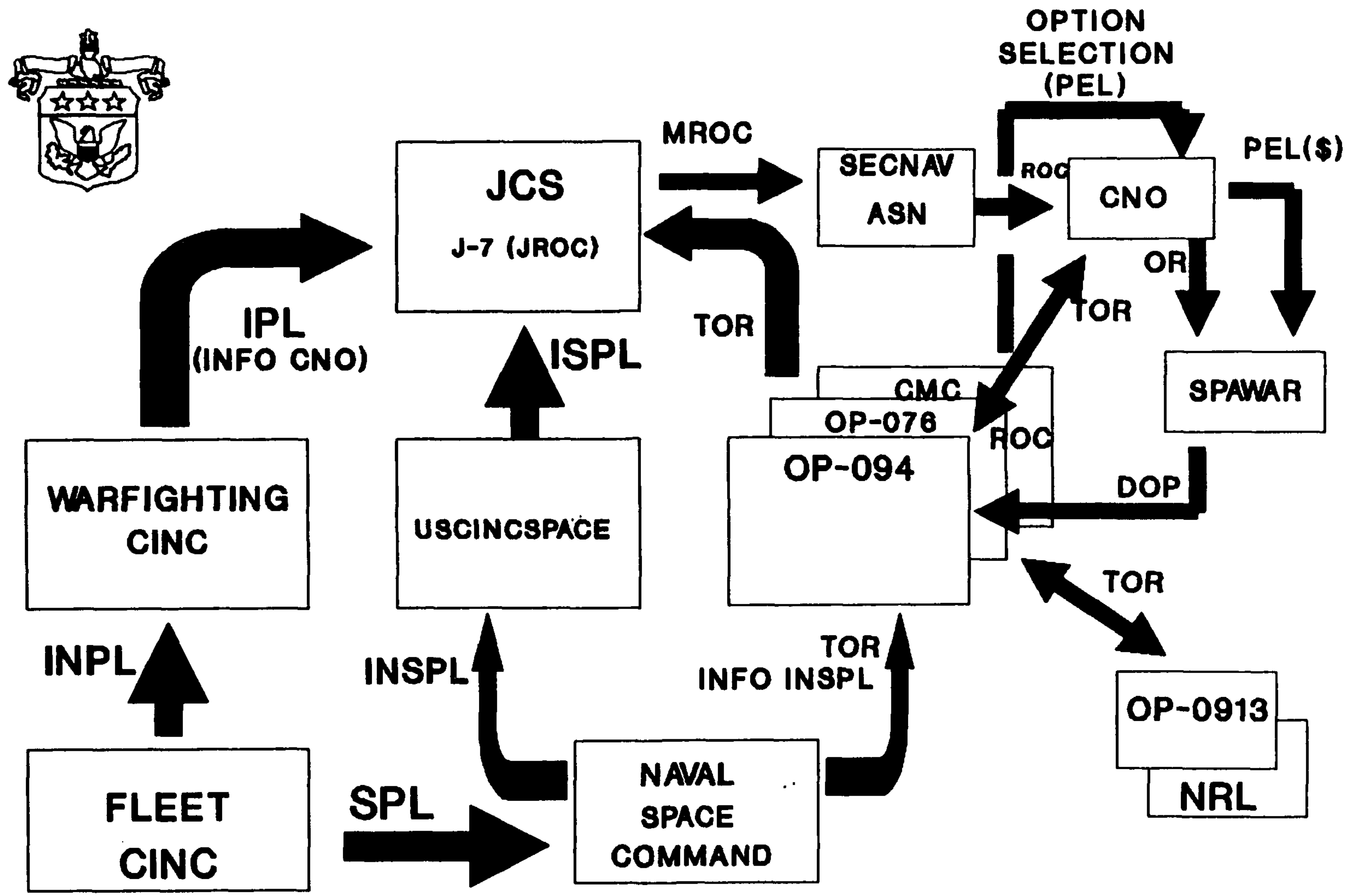

Figure 4: Naval Space Requirements Routing

opportunity is seen for the exploitation of space systems. Such input is heavily dependent on the level of exposure to and experience with space assets. OPNAV Instruction 5000.42D delineates the process for fleet operators to initiate a tentative operational requirement (TOR) for any system, including space systems. These can be proposed at any time, but are especially important as part of the annual POM process. The TOR goes from the originating operational unit, through the chain of command, to the Fleet CINC (or FMF). The Fleet CINC and FMF headquarters have staff positions specifically identified to handle space issues. Some of these are filled by officers, while others are civilian. For example, a Navy Commander (O-5) staffs space TORs for CINCPACFLT, while CINCLANTFLT's point of contact is a civilian, and FMFLANT shares the responsibilities between a civilian and a Lieutenant Colonel.

Efforts to specifically solicit space TORs from operational units does not appear to be pursued as such. Some years ago, CINCPACFLT publicized a program called Fleet TIP (Tactical/Technical Improvement Program). The program was general in nature, not targeting space in particular, but offered the incentive of award recognition or cash bonuses for worthy submissions on a non-competitive basis. A similar program targeted to space issues could be initiated by CINCs, NAVSPACECOM, or OPNAV. A program of that nature would, no doubt, produce usable space systems concepts (even if only from designated space subspecialists), and serve to promote

educational awareness in the fleets on space issues and applications.

A TOR is not automatically designated as a space issue even if submitted by the originator to the Fleet CINC as such. Conversely, the Fleet CINC may determine that a particular mission requirement would be best addressed by space assets, and staff the TOR in that manner. This determination is a fundamental part of the review process at this level since this is the echelon at which space expertise positions are normally first found. For example, if a TOR is submitted on an intelligence or communications requirement, the respective intelligence or communications staff positions would review the TOR in addition to the space staff officer. After study and review by the appropriate staff officer(s), they would together determine whether the requirement is sufficiently documented, rule on the validity of the TOR for further processing, and ensure the TOR is not already covered under existing or planned capabilities. Then the potential avenues of meeting the mission requirement are determined. When space systems are considered as one of the options, the TOR is forwarded to the Naval Space Command for further review and determination. During the POM process, TORs are submitted by the Fleet CINCs as Space Priority Lists (SPL) to NAVSPACECOM. Additionally, Fleet CINC SPLs are solicited by NAVSPACECOM during odd numbered years for inclusion in the revision to the Naval Space Master Plan (NSMP). At the same time the Fleet CINC forwards the SPL to NAVSPACECOM, an

Integrated Naval Priorities List (INPL) is forwarded to the appropriate warfighting CINC in the operational chain of command. These lists address all warfighting requirements including space requirements. The SPL to NAVSPACECOM refines and highlights the space systems requirements through a separate avenue.

III. WARFIGHTING CINC

The INPL submitted by the Fleet CINC is integrated at the Warfighting CINC level with similar lists from the other services, reviewed, validated, prioritized and incorporated in that CINC's Integrated Priority List (IPL) to JCS. The CNO receives an information copy. The CNO must, by law, respond to the top five CINC priorities. The level of support for the TOR must be shown, or non-support must be justified.

IV. JCS (J-7 JOINT REQUIREMENTS OVERSIGHT COUNCIL)

The JROC of JCS reviews the IPLs submitted by all the warfighting CINCs. JCS also receives USSPACECOM's Integrated Space Priority List (ISPL). As with other levels of review, the staffing process looks at the value added, the feasibility and affordability of proposed requirements. They are also deconflicted or combined with existing or concurrent proposals. After JCS validation, the Required Operational Capability (ROC) or Multi-command ROC (MROC), is forwarded through the Secretary of the Navy to the CNO. Generally, ROCs are stated in broad, long-range planning terms, typically over six years out.

V. NAVSPACECOM

NAVSPACECOM hosts a conference every other year as a scrub on SPLs submitted by Fleet CINCs and FMFs. Fleet CINC and FMF space staff representative attend the conference and discuss, refine and recommend prioritization of requirements for inclusion in two products. The annual POM process requires NAVSPACECOM to forward an Integrated Naval Space Priorities List (INSPL) to USSPACECOM. POM-94 is currently being worked. Since 1987, NAVSPACECOM has published the Naval Space Master Plan on an every other year basis. A composite requirements list from the conference is included in the updated master plan.

Naval Space Command takes the TORs and SPLs for validation applying the resident expertise of its staff. The TOR is refined and also forwarded to the CNO via the OPNAV staffs.

VI. USSPACECOM

In addition to inputs from his other component commanders, USCINCSPACE reviews and validates TORs in NAVSPACECOM's INSPL. When approved, these TORs are prioritized with Army and Air Force TORs, and forwarded to JCS as USSPACECOM's Integrated Space Priority List (ISPL).

VII. CNO/OPNAV STAFFS

There have been changes in the OPNAV staffs within the last year which impact the space requirements process. OP-094 was designated the Navy's space requirements sponsor. Previously,

OP-094 was primarily concerned with space as related C^3I issues while OP-07 addressed some of the EW programs in space. Both staffs still review TORs, but the emphasis has changed.

A. Space and Electronic Warfare Directorate, OP-094

As the space warfare directorate, OP-094 is the advocate for space requirements in the same manner in which DCNO (Air) would advocate aircraft acquisition programs during the POM process. However, "by comparison to the other so-called platform sponsors, OP-094 has a relatively small annual budget of roughly $3 billion for SEW authority."[1] A single space system can cost $10 billion.[2] OP-094 evaluates the importance, costs, technical risks, and R&D aspects of TORs. The OP-094 staff briefs OP-07. OP-07 prioritzes space inputs with other warfare requirements.

B. DCNO, Naval Operations (Naval Warfare), OP-07

Within the staff of Vice Admiral J.D. Williams (OP-07), the Electonic Warfare Division reviews space TORs. In a similar fashion, other OP-07 warfare divisions staff TORs in their fields, with one notable difference. While tacair officers usually staff tacair issues, and air ASW officers staff issues related to their warfare experience, and amphibious issues are staffed by marines and officers with surface warfare designators, space issues are generally handled by cryptology, intelligence or aviation officers, not space subspecialists. (A lack of space subspecialists also exists, to a lesser degree, within OP-094). OP-07 functions as the "honest broker" in the budgeting

OP-07 functions as the "honest broker" in the budgeting priorities process. At six to twelve month intervals, a TOR scrub meeting is held to review and prioritize warfare requirements received to date. The OP-07 staffs take inputs from the requirements sponsors (OP-094 for space) to assist in the decision process. The OP-07 staff determines whether the required capability is already being built, whether a previously approved TOR addresses the requirement, or whether black systems can be brought to support the requirement. Once the scrub conference prioritizes the TOR and considers budgetary constraints, OP-07 validates the selected TORs and they become ORs (Operational Requirements) subject to final CNO approval. The CNO forwards approved ORs to SPAWAR.

Much the same process is used by the OPNAV staffs to respond to ROCs which come in through CNO/SECNAV from JCS.

C. Navy Test & Evaluation and Technology Requirements Directorate, OP-091

Throughout these processes, support and liaison is provided by OP-091 (formerly OP-098) for technology assessment, T&E, and programming and budgeting. Even if no technical support is furnished, OP-091 reviews the paperwork for compliance with logistics programming and budgeting directives.

VIII. SPAWAR

When SPAWAR receives the validated OR from CNO, it is tasked

result of studying the technical aspect options with associated costs and risks. Where possible, low-cost options "piggy-back" required systems onto already approved projects. One such outstanding success was the addition of strategic EHF communications packages onto the last two FLTSATs launched, at a very low incremental cost. The DOP, offering several choices, is forwarded to CNO and staffed by OP-094 who recommends the selection of a specific option. Upon OP-07 concurrence, the option is assigned a program element line (PEL) in the budget and funded for development. SPAWAR assigns a program manager to the project to proceed with development and acquisition following CNO final approval.

IX. Naval Center for Space Technology/NRL

Chapter II discussed these organizations. As is self-explanatory, the technology center of NRL serves as the Navy's in-house resident expert on technology issues and provides liaison and advice as required.

ENDNOTES

1. "Space and Electronic Warfare Comes of Age," Proceedings, January 1991, p. 94.

2. Naval Studies Board, Implications of Advancing Technology for Naval Operations in the Twenty-First Century, Vol. IV, Space Technology, p. 10.

CHAPTER FOUR

PIM

I. GENERAL

Since the days when ancient mariners first ventured out on the high seas, men have employed the concept of PIM. PIM is a nautical acronym which stands for position and intended movement. In other words, to arrive at his destination, the sailor had to know not only where he wanted to go, but he had to continuously estimate and regularly determine where he was and whether course corrections were necessary. In the days of sailing ships, seafarers charted their courses by the stars, sun and compass, and measured their progress (speed) by flotsam or knotted lines. Today we use far more sophisticated means to accomplish identical tasks. Compass and knotted line dead reckoning techniques have been replaced by on board inertial computers for internal estimates of position. Ships now obtain their external fixing information from man-made stars (satellites).

The Navy has employed comparable techniques over the years to chart its organizational course in space programs. From time to time, it has conducted internal studies using panels and committees convened by CNO directive to recommend space policy. The Navy has also obtained "external fixes" by employing the

services of professional study boards for an impartial evaluation of its "position and intended movement." Some of those recent reports have not been flattering, virtually suggesting that the Navy's space program was DIW: another nautical acronym meaning dead in the water; adrift without direction or simply not moving.

II. DESTINATION

The Department of the Navy goal in space, as set forth in the Maritime Strategy, is to "exploit the unique benefits of space in order to support operational naval forces."[1] This is a general description which includes the traditional "scouts and messengers" force enhancement role of current space systems, but leaves open the option for denying the effective wartime use of space to an adversary as well as eventual defensive and offensive force application from space.

To accomplish this end, the Navy has set its sights on developing an across-the-board Naval Space Warfare Architecture (NSWA) by the year 2010.[2] The plan includes detailed objectives for developing and acquiring space systems which fill identified requirements in the space mission areas depicted in Figure 2.

A. New World Order

The importance of space to U.S. naval operations will greatly increase as a result of the disintegration of the Warsaw Treaty Organization, and diffusion of dangers in an emerging multi-polar world. As the challenge shifts to a more diverse,

geographically scattered and unpredictable threat, naval forces will likely have primary initial responsibility for bringing forces to bear. Future low-intensity conflicts will require highly discriminate operations. Continued diffusion of advanced weapons technologies, possibly to one day include space capabilities, to third world nations will put increasing pressure on our capabilities. All the while, Soviet space capabilities are being maintained and enhanced, and continue to pose a threat to the U.S. Navy. Surveillance and C^3I capabilities to counter such threats will place a premium on space assets responsive to naval operational commanders.[3]

B. Roles and Missions

To achieve the Naval Space Warfare Architecture and meet these threats, the Secretary of the Navy established several roles and missions for the Navy's space efforts to aim at. These include the development of a viable career progression for an expanded cadre of qualified naval space subspecialists, and acquisition of space systems which support naval missions.[4]

Because of the tremendous price tags on space systems, as well as their broad applicability to other services and agencies, future space systems will be mostly joint ventures. Navy success in this regard will hinge, in large degree, on its committment to development of a qualified personnel pool of smart buyers and builders of space systems. They will ensure the Navy requirements enjoy equal footing in joint acquisition programs.

III. POSITION

A. Dead Reckoning

Chapter I discussed the "Connolly Committee" report which essentially became the Navy's first master space plan. Not until 1987 would another similar document be published on naval space. Following the Vietnam War and the 1974 recession, the Department of Defense cut back on money and manpower. One result was that the naval space programs were cut to preserve funding for traditional sea forces. The Navy's space program did not soon recover, despite the military build up of the Reagan years.

In 1982, then CNO Admiral Thomas Hayward tasked a CNO Long Range Planning Group (LRPG) to examine the role of space in naval warfare, and to suggest an organizational arrangement to respond to the space challenge. In part, the LRPG concluded that the "broad use of space is inevitable" and that "the Navy needs to determine where its interests in space lie and where it wants to go."[5]

B. Fixing

In May 1988, after 18 months of concentrated study by 29 panel members of the National Academy of Sciences' Naval Study Board, their "NAVY-21" report concluded that "the Navy space program has always been searching for a home, an organizational structure, a sponsor, and an accepted role in the operational Navy. This unsuccessful search is still ongoing."[6]

The study did not fault policy. Policy documents were

evaluated as clear and sufficient. The study cited rather the lack of a coherent Navy space program, and a lack of substantial funding support in the Navy budget. The study also noted that identified space billets exceed the Navy's ability to fill them with qualified personnel, and forecast that such a situation will continue for 25 years unless major steps are taken to provide career opportunites for space-qualified personnel.

When the Navy-21 study was published in 1988, it observed that the Navy's anemic space acquisition program consisted of only two projects in development: UHF Follow-On and Navy Remote Ocean Sensing System (NROSS). Five months after the study was published, NROSS funding was cancelled leaving UHF Follow-On as the only active program. One senior study participant said "We're not doing that well in space. Someone should pay attention to that."[7]

IV. INTENDED MOVEMENT

Someone did pay attention, or at least is beginning to. In May 1989, Vice Admiral Jerry Tuttle became OP-094, Director of Space, Command and Control. Fifteen months later, the CNO made OP-094 the Space and Electronic Warfare Directorate with VADM Tuttle remaining at the helm. Naval space finally had its high-powered advocate in the form of a warfare directorate. The Navy space program was revitalized in some important ways.

A. SEW

In July 1990, VADM Tuttle hosted a conference to discuss space and electronic warfare (SEW) projects and time lines. Commander, Carrier Group Seven, Rear Admiral Zlataper walked away from that meeting as the key SEW sponsor for the Pacific Fleet. The first Navy Warfare Tactical Data Base deployed for Operation Desert Shield on board USS Saratoga (CV-60). The advanced data fusion system was the Standard Desktop Computer II and a fully rack-mounted Sun-4 workstation. It hosts the software for systems which display space products on a real-time basis from Fleet Command Centers via satellite communications. The Independence (CV-62) battle group has the same system in the Persian Gulf for operational evaluation. All battle groups will get the system as they deploy.[8]

Not only does this SEW system vastly improve fleet capabilities in the use of space products, but it serves to broaden the fleet's exposure to space in a way that should pay handsome dividends in years to come. The fact that the system deployed into what became a wartime theater is a bonus from the standpoint of lessons learned in a conflict environment.

B. Naval Space Command

1. Naval Space Master Plan: For the first time in almost thirty years, a Naval Space Master Plan was published. The current version contains chapter headings which alone are instructive of the progress being made since "Navy-21": Naval

Warfare Requirements; Space Systems Assessments; Current Investment Profile; Implementation of Goals and Objectives; and an annex on POA&M. The formulation of the plan helped to revitalize space acquisition by precipitating a long list of new requirements and development programs.

2. Space Tactics Manual: The centerpiece of a larger effort to educate fleet users about space systems was the Space Tactics Manual described in Chapter II. NAVSPACECOM's other educational efforts include videos, enlisted correspondence courses, "The State of Space" messages, and customized seminars and training visits for fleet users. In addition, NAVSPACECOM participates in fleet exercises and wargames. Before the new SEW system deployed to the Persian Gulf for Operation Desert Shield, designated personnel received thorough training in its operation and applications. The training was conducted on the ship by NAVSPACECOM training teams.

ENDNOTES

1. Secretary of the Navy. SECNAVINST S5400.39A Ser 06/8S599074: Navy Space Policy. 5 December 1988.

2. U.S. Department of the Navy. OPNAVNOTE S13300/CMCNOTE S13300: Naval Space Master Plan. p. E-9.

3. CNO Executive Panel Task Force, Report of the CNO Executive Panel Task Force on Navy Space Policy, pp. 2-3.

4. Secretary of the Navy. SECNAVINST S5400.39A Ser 06/8S599074: Navy Space Policy. 5 December 1988.

5. CNO Long Range Planning Group, The Role of Space in Naval Warfare, 8 June 1982.

6. Naval Studies Board, Implications of Future Space Systems for the U.S. Navy, p. 16.

7. "Navy Mulls Place in Space," Military Space, June 19, 1989, p. 3.

8. "Space and Electronic Warfare Comes of Age," Proceedings, January 1991, p. 95.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

I. DISCUSSION

A. Institutional Structure

Although it would be inappropriate for a paper of this sort to develop highly specific organizational recommendations complete with wiring diagrams, it will outline below some general elements important to future organizations. The Navy may find that the best structure will be one that does not conform to conventional Navy organizational practices. The potential importance and unique nature of space systems warrants at least a consideration of a special approach. The Navy must focus on achieving a space structure best suited to increasing its role in joint acquisitions, and fully exploiting the potential application of future space systems to naval operations.

Equally essential is the development of strong formalized ties to the rest of the Navy so it can continually relate the value of space to Navy operational users, and at the same time constantly assess the needs of those forces for further space produced information and services.

B. Personnel Policy

Clearly, success in establishing these formalized ties will depend greatly on the quality of the individuals involved. Therefore, organizational structure is inextricably linked to personnel policy in this regard. The policy must emphasize training and education opportunities, but most importantly the development and implementation of a career system for space specialists that is finally credible. Special incentives may be required in the short term to encourage the building and retention of a qualified cadre, but lower cost options are also available.

II. ORGANIZATIONAL CHANGE

A. OPNAV

Thirty years ago, the choice to incorporate space organization into existing naval organization structure was probably the best option. It enabled the Navy to "hit the deck running" and was largely responsible for its early successes in the new field of space. The CNO Long Range Planning Group saw in 1982 that the time had arrived to establish a separate vertical structure, as the Air Force had long since done. A vertical structure was the best avenue of continued progress in space missions. In 1983, the Naval Space Command was established. However, many vestiges of the old system remained within the OPNAV structure.

OP-094, as noted earlier, was made the space warfare

directorate in 1990, but with relatively limited budget authority. Particularly in view of the high cost of space systems, it seems that the lack of budgetary priority cited by the Navy-21 study still exists. With the 1990's down-sizing of the force and the overall budget, naval space will again come under fiscal pressure as it did in earlier decades. The Navy must learn from this part of its space history, if it is to avoid a second space recession. The history of the early space successes by the Air Force point to a primary factor being its willingness to commit the large funds required to become a major player in space acquisitions.

Other Navy warfare sponsors have the status of DCNO, and it is not unlikely that eventually the space sponsor will be so designated. A prerequisite to this, however, is a personnel policy which establishes a separate warfare designator and career path for space officers rather than relying on the current system of subspecialty assignment.

Space requirements staff officers within OP-07 are found in the Electronic Warfare Division, the title of which does not yet recognize the new warfare directorate for space. As mentioned earlier, the space desks are normally staffed by other than space subspecialists.

B. SPAWAR

While some progress has been achieved in the consolidation of operational commands under a single, separate vertical command

structure, the materiel/program development structure still reflects the fragmented structure noted in the Navy-21 study of 1988. Chapter II discussed the busy history of reincarnations of space logistics organizations. Yet, one more change is recommended. Space programs, because of their unique nature of high cost and broad applicability, will nearly mandate a joint approach in the future. Space sytems programs should be separated from the present systems command and combined with the Naval Center for Space Technology. A Space Systems Command in charge of the technology center would shift the historical emphasis of NRL from scientific R&D to a more operational orientation, and enhance the Navy's interests in joint acquisition ventures. Such a change would be consistent with the most recent version of the Navy Space Policy (December 1988) which states, in part, that the Naval Center for Space Technology must serve as the "focal point for a strong space technology base and will provide expert assistance in the development and acquisition of space systems which support naval missions."[1] Though not on the same scale nor having the same extensive history as NRL, it is worth noting that the Army Space Technology Research Office (ASTRO) reports directly to the Army Materiel Command (AMC). A separate, vertical Space Systems Command structure now needs to follow the establishment of the vertical operational structure.

The single most prominent problem in space systems acquisition is the tremendously long time involved in the

acquisition cycle. This proves to be not just an obsolescence or national technology leadership risk, but works against the motivation and continuity of personnel in the business. The typical acquisition cycle is seven years and growing. The typical military assignment tour is two to three years. Therefore, there will be at least three generations worth of officers working any one program who never realize anything more than incremental success on a project. The extended cycle is even more devastating to the TOR process which generates the programs. If results are not seen on "their watch", operational users will have reduced incentive to contribute to the process of identifying space systems requirements. While it may easily be understood that many systems might be "turnover items" to immediate successors, longer timetables are less appreciated by forces for which the work-up cycle is measured in months. The most complete recommendation noted in this regard is found in the Navy-21 study. Although the recommendation quoted below was applied to Navy systems acquisition in general, it is especially useful for space systems when considered in conjunction with the recommendation above to incorporate the Naval Center for Space Technology under a separate Space Systems Command. "The Navy must take steps to reduce development and acquisition cycle time in the combat information network and related areas, because there is a mismatch between the rapid time of technological advance (on the order of 5 years and shrinking) and the growing acquisition cycle time (on the order of 7 years and growing).

This means more use of ad hoc, rapidly prototyped developments, ... accelerated introduction of selected systems with higher risks in both technical and operational learning may be necessary; the use of new technologies while they are still new, in the high-priority areas, is essential if the United States is to maintain its lead in deterrence. In appropriate cases such use can be accelerated by initial application in test beds that later become prototypes and that can be transferred to operational use."[2] Space offers a unique opportunity to do just that, as was seen earlier in the Navy's incorporation of EHF test packages on the last FLTSAT launches.

C. Miscellaneous

Though closely tied to the eventual evolution of a credible career path for naval space officers, the current SEW concept foreshadows what will likely become an integration of space officers into all warfare battle and headquarters staffs similar to the way intelligence officers are assigned today. The Navy should pursue an early realization of such a practice in order to achieve the goals mentioned in paragraph I.A above. A proposed change such as this which cuts across existing organizational entities in an area not yet recognized by most of the Navy as being of major importance will likely be viewed by many as unnecessary and undesirable. Yet, without such an integration, the full potential of space's impact on naval operations may not be realized. This integration is nowhere more critical than in

the Pentagon staffs. Working on those staffs affords a unique opportunity to be exposed to a wealth of information that could lead alert space staff officers to apply space requirements to numerous issues not available to fleet operational officers. As an interim measure, Naval Space Command may need to create remote staff billets attached to OP-094 and OP-07 for example. Additional billets should be added with assignments at the Joint Space Program Office at the Air Force Space Division, and the Joint Requirements Oversight Committee (JROC) in JCS. Space officers in those assignments would aid in influencing those programs to ensure the Navy's requirements are fully addressed. Additionally, Naval Space Command would have greater success in receiving space TORs if remote staff representative assignments were initiated to fleet and warfighting CINC staffs. A space version of the earlier mentioned Fleet TIP program should also be considered.

III. PERSONNEL PROGRAMS

To a great extent, the success of the Navy in the emerging joint environment of space systems acquisition will depend on the success of its personnel policy to create a quality cadre of professional space officers.

While enlisted personnel specialties (NECs) may also eventually evolve from SEW and SPADOC experience, this paper will only address officer corps issues. The author was struck early on in the research of this paper by the nearly unanimous,

path for space subspecialists. Experience indicated that subspecialty assignment in space-related billets was not career enhancing toward promotion, command selection or even retention (anti-SERB value). Until the Navy establishes a credible and attractive alternative to the present subspecialty path, it will be unable to produce an adequate cadre of quality space officers. The result will be an inability to fully exploit the Navy's potential in space. It will be left further behind the Air Force, which has a specific career warfare designator and career path for space officers from 2nd LT to General.

The 21st Century will probably see the evolution of a warfare designator career path similar to the way pilot and naval flight officer designators evolved in early naval aviation. The early achievement of this goal will ensure the development of junior officers in this field, and provide the increased pool of personnel for broadened assignment as mentioned in paragraph II.

An interim measure which can serve as a stepping stone to this eventuality is the creation of an alternate career path (command equivalent) as was initiated by the Navy in the 1980s for the Materiel Profession (MP) specialty. Though the MP specialty is, in practice, restricted to post-Commander command conversions, the original goal was to offer the program to competitive O-4s and above as a non-warfare command career path leading all the way up to flag rank. Promotion boards were required to select these redesignated officers in the same percentages as their original warfare communities. Assignments

percentages as their original warfare communities. Assignments would, however, be made continuously within MP coded billets.

Space systems is taught as a hard science engineering curriculum at Naval Postgraduate School. As with other highly educated officers such as doctors or nuclear engineers, the Navy would have the added challenge of trying to retain its marketable talent. A bonus program may eventually be needed, but is not likely to be resourced any time soon. By comparison, the alternative career designator a la the MP program offers a low cost alternative if actually implemented at the O-4 or senior O-3 level.

Whatever the alternative selected, it is clear that the Navy is critically short of officer expertise in space systems technologies. Until the Navy embarks on an aggressive program to acquire, train, promote and retain space officers, its lack of an adequate, stable workforce will serve as a barrier to the Navy's full potential in space. These officers are key to identification of space requirements and the full utilization of space assets in support of naval forces. In the 1980s there was a public outcry about $700 hammers. The Navy met the MP crisis of the 1980s when Secretary John Lehman signed the new career path into being. Though not heralded by public outcry, similar problems now exist in the space personnel arena. These also require immediate attention at the Secretary of the Navy and Chief of Naval Operations levels.

IV. REFRAIN

"The U.S. Navy (and the other Services) could not function effectively without access to space and when subject to unopposed Soviet observation from space. Establishing requirements for space systems important to the Navy and supporting their development, acquisition, operation, and protection regardless of which service or agency is responsible are among the highest priority issues for the highest levels of Navy management."[3] This paper has offered some suggestions to enhance the process which accomplishes that high priority.

V. SUMMARY

The Navy made good progress toward a unified space organization by consolidating its operational space commands into a separate, vertical structure in 1983. With the 1990 establishment of the warfare directorate for space in OP-094, naval space obtained a high-powered requirements advocate. What remains is for the same progress to be made in materiel and personnel. A separate, vertical Space Systems Command incorporating the current Naval Center for Space Technology should be established. A "vertical" personnel policy must also be realized in the form of a primary space professional career path in place of the subspecialty designations now in use.

ENDNOTES

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